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AUTHOR Chen, Lei-da
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ABSTRACT

The last few years have witnessed continuous power shifts in the information structure of organizations. As a result of these changes, end-user computing (EUC) has been growing at a tremendous rate. This paper discusses the three functions of Information Centers (IC) to support EUC in organizations: training, technical support, and control. A study was performed to seek the relationship between the three functions and EUC success. A questionnaire was distributed to employees in two metropolitan areas; the main criteria in choosing the samples was that the respondent must be a full-time employee at an organization which implements a substantial degree of EUC. The results of the study indicate that ICs' ability to effectively deliver support to end-users significantly affects user satisfaction and that providing the types of support end-users prefer will result in a higher satisfaction level. The contribution to practitioners and researchers is also discussed. (Contains 37 references.) (Author/AEF)

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A STUDY ON TRAINING, TECHNICAL SUPPORT, CONTROL AND THEIR EFFECT ON EUC SUCCESS

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Lei-da Chen
University of Memphis

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The last few years have witnessed continuous power shifts in the information structure of organizations. As a result of theses changes, end-user computing (EUC) has been growing at a tremendous rate. This paper extensively discusses the three functions of Information Centers (IC) to support EUC in organizations: training, technical support, and control. A study was performed to seek the relationship between the three functions and EUC success. The results of the study indicate that ICs' ability to effectively deliver support to end-users significantly affects the user satisfaction and that providing the types of support end-users prefer will result in a higher satisfaction level. The contribution to practitioners and researhers are also discussed.

INTRODUCTION

The last few years have witnessed continuous power shifts in the information structure of organizations, for example, the shift from mainframe systems to the powerful PC networks (Udo & Kick, 1994), the shift from plain DOS-based software to user-friendly, function-rich, and integrated software suites with GUI, and the loss of IS departments' monopolistic power in information processing to end-users. As a result of these phenomena, end-user computing (EUC) has been growing at a tremendous rate. It was estimated to grow at 50 to 90 percent every year (Cronan & Douglas, 1990) and was recognized among the most important information systems issues by both academicians and practitioners (Caudle & Corr, 1991). Previous studies have suggested that EUC has several advantages over the traditional IS department domination approach including shortening lead time for system development, giving users more control and flexibility in information they need, and lowering the organization's cost for information processing (Leitheiser & Wethebre, 1986a); however, improper management of EUC can lead to disastrous consequences (Davis, 1984). Therefore, many studies have been conducted with respect to the managerial issues of EUC in attempts to provide the information centers (ICs) with greater insights into how to achieve the organization's goals through better management of EUC.

One of the most important deliverables of an IC in the organization is EUC (Jones, 1996). It is well acknowledged that end-user support and control are the two fundamental managerial issues in EUC, and they were proposed by Alavi et al. (1988) as the two primary activities which determined how EUC contributed to the overall success of the organization. Mirani and King (1994) defined support as "the provision of various kinds of assistance to users in their computing activities" and control as "seeking to provide limits, rules, and regulations for such activities".

End-user support provided by ICs, which basically consists of end-user training and technical support, proves to be the best means of ensuring the success of EUC by enhancing the development and growth of EUC in the organization, and it is critical to user satisfaction and EUC effectiveness (Mirani & King, 1994; Alavi et al., 1988; Compeau et al., 1995; Garavan & McCracken, 1993). The growth of EUC is giving rise to increasing demand on ICs for more support (Forgionne & Willits, 1987). Due to their different nature and domain, training and technical support are often discussed separately.

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End-user training entails activities such as conducting formal teaching on specific EUC topics, and it is usually achieved in a classroom environment. As a study has found that users normally spend 4 of every 12 computer hours trying to learn how the system works (Radding, 1989), training becomes an imperative EUC management activity to promote more effective and efficient use of computers. Regan & O'Connor (1994) stated that ICs' understanding of the underlying educational philosophy, including behavior approach and cognitive approach, proved to be helpful in tailoring the training programs to fit different end-users and training topics.

Unlike training, technical support is an ad hoc support activity which is conducted when end-users encounter EUC problems. Responsiveness of ICs to user problems is ranked high among major end-user concerns (Rifkin, 1986), therefore, adequate technical support resources must be allocated to ensure user satisfaction and smooth operation. End-user training is time consuming and costly, but it provides lasting impact on users' ability to effectively and efficiently use the EUC tools. Technical support has the advantages of saving resources (eg. time and money) and targeting the problems directly, it does little in helping users have thorough understanding of the solutions and ensuring fault-free operation later on.

As a by-product of the distribution of information processing power of EUC, control has received a great deal of research attention. Literature on the control mechanisms including policies of hardware/software acquisition (Mclean & Kappelman, 1993; Montazemi et al., 1996; Munro and Huff, 1988; Lewis, 1996), security (Fink, 1995; Nord & Nord, 1994), backup (Garcean & Pozanski, 1995), testing and documentation (Cale, 1994; Lewis, 1996), and ethics (Spiro, 1989) have emphasized the importance of imposing sufficient control in order to shape the growth of EUC. However, it has also been uncovered that as the level of control increases, user satisfaction tends to decrease (Bergeron & Berube, 1990). Despite its importance, few organizations have impelemented comprehensive procedures to ensure adequate control (Rittenbery, 1993).

Control involves developing and implementing policies regarding hardware/software acquisition, security, testing and documentation, and ethics, and if used well, these policies are expected to lead to a more effective partnership between end-users and ICs (Montazemi et al., 1996). Such partnership is believed to "better utilize information resources to meet organizational objectives, overcome these human, political problem and facilitate resolving many of the technical ones as well" (Kappelman, 1995, pp.36). Although control was found to have a negative relationship with user satisfaction, it serves as an important stabilizer for today's extremely dynamic EUC growth, thus the lack of it will put EUC growth at risk.

Providing adequate training and support along with developing policies for control are factors consistently related to the success of EUC (Rittenberg & Senn, 1993), therefore managing these activities should be raisen to the top priority of ICs. End-users being the internal customers to ICs (Jones, 1996), providing satisfying EUC helps improve their productivity, operational efficiency, decision making capabilities, and quality of work life (Khan, 1992). To ensure that the activities of support and control are managed effectively, it is crucial for ICs to understand the importance of their responsibilities and be able to prioritize their activities in order to design the most appropriate EUC management solution with the resources available.

ICs have always found themselves struggling under the pressure from both end-users who ask for more support and the management who demands more control. Many studies have been dedicated to seeking the equilibrium between the control and support (Munro & Huff, 1988; Saarinen et al., 1988; Metz, 1988; Leitheiser & Wetherbe, 1986b; Gerrity & Rockart, 1986). Among them, Saarinen et al.'s (1988) study classified EUC management alternatives into four levels: laissez-faire, containment, expansionist, and controlled growth and found the last two approaches accelerated the growth of EUC to reach an advanced state faster than the first two. Study conducted by Leitheiser and Wetherbe (1986) revealed that effective service delivery of ICs was of increasing importance to users.

A number of recent studies suggested that the importance of ICs in EUC success was over-

emphasized. Bowman et al.'s (1993) study found ICs the least preferred source of support among all studied which were other users, vendor manuals, purchased books, and program help screens. The reason for such understatement is due to the poor performance of ICs in many organizations, and it should not discount the importance of ICs in achieving EUC success. Rittenbery and Senn (1993) identified the following 5 factors to be consistently associated with successful EUC:

1. EUC responsibilities have been defined and policies have been developed (Control).
2. Effective information centers have been established to support EUC needs (Support).
3. Mechanisms to share and protect data have been developed and are functioning (Control).
4. End-users are being trained and educated (Training).
5. End-user developments have received appropriate allocations.

Four out of 5 of these factors involve ICs' ability to provide control, support, and training while the other one deal with the information infrastructure and resource allocation. Guimaraes and Igbaria (1994) discovered that ICs' performance directly affected the benefits the organization has gained from EUC activities and the overall business performance. Therefore, the importance of ICs in achieving EUC success cannot be underestimated.

Delone and McLean (1992) identified three reasons why user satisfaction had always been widely used as the single measure of IS success, and they are 1) high degree of face validity, 2) reliable tools for measure have been developed, 3) conceptual weakness and unavailability of other measures. Therefore, this study employs user satisfaction to represent an important aspect of EUC success. This rationale leads to my first hypothesis:

Hypothesis 1: Training, technical support, and control provided by ICs are statistically significant discriminators for user satisfaction.

White and Christy's (1987) normative model assumes that ICs should provide methods for improving EUC effectiveness and efficiency in order to accomplish their mission, and their study found most ICs deficient in doing so. This study hopes to find out whether training, technical support, and control provided by IC are statistically significant discriminators for EUC effectiveness and efficiency, and if so, what is the order of priority among these activities. In this study, EUC effectiveness is defined as assisting end-users to make better business decisions, and EUC efficiency as saving end-users time and effort in work.

Hypothesis 2: Training, technical support, and control provided by ICs are statistically significant discriminators for EUC effectiveness.

Hypothesis 3: Training, technical support, and control provided by ICs are statistically significant discriminators for EUC efficiency.

In their study, Ford et al. (1996) acknowledged that demographic factors, prior computer training and experience had significant impacts on the participant's use of computers. Due to the different nature and impact of end-user training, technical support, and control, ICs need to understand different users' preference for these EUC management activities in order to manage EUC more effectively. Rivard (1987) discovered that support provided to end-users had the highest correlation with user satisfaction among the six factors that contribute to user satisfaction. I expect that higher user satisfaction should occur when ICs provide the kind of support preferred by end-users. To examine the correctness of this assumption, the following hypothesis will be tested.

Hypothesis 4: User satisfaction varies significantly with ICs' fulfillment of user preference of EUC management activities including training,technical support, and control.

METHODOLOGY

A questionnaire was designed in the attempt to capture the data needed in the studies. The first section of the questionnaire consists of inquiries on end-users' self-reporting satisfaction level, whether the implementation of EUC increases or decreases their efficiency at work and effectiveness in decision making, and the adequacy level of end-user training programs, technical support, and policies of provided by ICs

in the surveyed organizations. Three groups for every dependent variable are identified and shown in the following table.

TABLE 1
Groups for User Satisfaction, EUC Effectiveness, and EUC Efficiency

	Group 1	Group 2	Group 3
User Satisfaction	Not Satisfied	Neutral	Satisfied
EUC Effectiveness	Not Effective	Neutral	Effective
EUC Efficiency	Not Efficient	Neutral	Efficient

Although multiple attribute instruments to measure user satisfaction have been developed and are widely used (Doll et al., 1994), this study uses a single overall satisfaction rating. This approach was also used in other studies such as that of Edmundson and Jeffery (1984), Hogue (1987), and Langle et al. (1984) (Delone & McLean, 1992). It is valid because the concepts in this study such as training, technical support, and control are all studied in a general sense, therefore, a measure of overall user satisfaction rating should be employed. Single overall effectiveness rating and efficiency rating are employed for the same reason as user satisfaction.

The second section of the questionnaire is devised to find out an end-user's most preferred EUC management activity. The variable will be analyzed in conjunction with some variables in section one. If the organization fulfills the user's preference by providing adequate level of her preferred EUC management activity, then a fulfillment score of 1 will be assigned. Similarly, fulfillment score of 0 or -1 will be assigned if the organization provides less than adequate or none of her preferred EUC management activities, respectively.

The questionnaire was distributed to employees in two metropolitan areas. The main criteria in choosing the samples was that the respondent must be a full-time employee at an organization which implements substantial degree of EUC, thus all the responses were guaranteed to render valid data for this study. Among all the returned questionnaires, 48 were found to be complete and usable.

SUMMARY OF RESULTS

Fisher's linear discriminant analysis was performed to test the first set of the hypotheses, which is to find out whether the adequacy level of training, technical support, and control provided by IC significantly discriminate the outcomes of the organization's EUC effort including user satisfaction, effectiveness in decision making, and efficiency in operation. Statistical result shows that user satisfaction levels are significantly discriminated by these three factors. The Wilks' Lambda and Chi Square are calculated to be 0.51 and 29.39, respectively, and the significance is 0.00. The classification functions are displayed in Table 2. The result supports hypothesis 1, which predicts that the adequacy level of training, technical support, and control provided by IC are able to discriminate user groups with different satisfaction levels.

TABLE 2
CLASSIFICATION FUNCTION COEFFICIENTS

	Group 1: Not Satisfied	*Group 2: Neutral*	*Group 3: Satisfied*
Training	3.06	3.61	6.47
Technical Support	3.10	3.97	4.76
Control	0.36	0.15	-0.67
(Constant)	-7.51	-9.48	-15.42

TABLE 3
STANDARDIZED CANONICAL DISCRIMINANT FUNCTION COEFFICIENTS

	Training	*Technical Support*	*Control*
Coefficient	0.94	0.41	-0.36

Table 3 displays the standardized canonical discriminant function coefficients derived from the discriminant analysis. Among the three variables, training has the highest coefficient which indicates that the adequacy level of training is the most important element in predicting user satisfaction level. The negative coefficient of the adequacy level of control suggests that as ICs increases their control over EUC, users tend to fall into groups with lower

satisfaction levels. This finding is consistent with the previous studies which discovered the negative correlation between EUC control and user satisfaction.

TABLE 4
CLASSIFICATION RESULTS

	Predicted			
Observed	Not Satisfied	Neutral Satisfied	Total	% Correct
Not Satisfied	4 (50%)	3 (37.5%) 1 (12.5%)	8	
Neutral	3 (25%)	6 (50%) 3 (25%)	12	
Satisfied	1 (3.6%)	1 (3.6%) 26 (92.9%)	28	75%

Table 4 presents the classification results corresponding to the classification functions in Table 2. The classification functions perform better than a random proportional chance model, which would have a hit rate of (n1p1 + n2p2 + n3p3) / (n1 + n2 + n3), where p is the probability of belonging to a group, and n is the number of samples in each group. Based on the prior distribution of the samples, I estimated p1, p2, and p3 to be 0.17 (8/48), 0.25 (12/48), and 0.58 (28/48), respectively. Thus the hit rate from a random proportional chance model is 42.9%. The rate of correct classification using the classification functions obtained from the discriminant analysis is 75%, which is significantly higher than that from the random model.

The three variables are not found to be the significant discriminators for user groups with different efficiency and effectiveness levels, therefore, both hypothesis 2 and 3 are not supported by the statistical result. However, only 2 users claimed to have inefficient outcomes from using EUC while 42 claimed the opposite, thus the insignificant finding may be the result of the extremely unbalanced distribution of the samples among the groups.

The fulfillment scores and user satisfaction level are tested using correlation technique. The Spearman coefficient was 0.62 with a significance of less than 0.01, therefore, a positive correlation between fulfillment score and user satisfaction exists. This result supported hypothesis 4 which stated that an end-user is likely to have higher satisfaction level if the IC provides the EUC management activity that she prefers.

IMPLICATION OF THE STUDY

The relationship between EUC success and EUC management is the issue studied in this study. It was found that end-user training, technical support, and control significantly affect user satisfaction level. Among these three EUC management activities, training plays the most important role in ensuring user satisfaction. Technical support is another important means for ICs to increase user satisfaction. However, control is found to have a negative relationship with user satisfaction, therefore, it should be used with great caution. While most IS professionals have realized the importance of imposing adequate control to ensure the security and healthy growth of EUC, they should also understand that end-users' attitude towards control is often different from theirs. Based on this finding, the study went into detail to seek the relationship between the fulfillment of an end-user's preferred EUC management activity and her satisfaction level. It was discovered that an end-user is likely to have higher satisfaction if the IC provides the EUC management activity that she prefers. This finding has some important implication to ICs in predicting the outcome of their EUC management activities.

The findings of this study can be used as guidelines for ICs in designing their portfolio of EUC management activities in their organizations. Different priority should be assigned to every activity to amplify the returns to the investment in EUC within the limited budget. The findings also imply that ICs should form a close relationship with the end-user community and provide channels for communication, since the understanding of end-users' attitude and preference of EUC management activities can serve as an critical success factor for ICs. Instead of providing homogeneous support to all the end-users, ICs should carefully evaluate the user profiles and apply appropriate support to users with different characteristics. EUC being the dominant direction of information processing in organizations, the success of it will tremendously escalate the organization's competitiveness in the global market.

Due to the recent corporate downsizing, many companies are outsourcing their support efforts. A survey done by Computer Sciences Corp. In

1994 indicated that 61% of the North American firms would outsource their training and support activities (Kiss, 1994). Understanding the influencing factors in providing satisfying end-user support becomes a imperative competence for vendors specializing in these services to compete in this growing market.

LIMITATIONS AND FUTURE RESEARCH

The primary limitation of this study is the small number of observations. The sample size used in analysis is 48. This gives rise to the unbalanced distribution of observations among the three groups. The result of the analysis inevitably suffered from this limitation.

An important dimension omitted in this study is the variation within every EUC management activities discussed here. End-user training, technical support, and control all provide a wide variety of choices within themselves. Training can be conducted with behavior approach, which emphasizes drill and practice, or with cognitive approach, which encourages the study of mental processes such as remembering and problem solving (Regan & O'Connor, 1994); technical support can be provided through a number of media including telephone, which has the lasting advantage of responsiveness and directness, recently emerged electronic support using E-mail and World Wide Web, on-line help, and etc. (Piquet, 1996); Control also covers a wide range of issues including hardware/software acquisition, security, and ethics. I realize that different choices within the three activities may render different outcomes of EUC. A possible arena for future research is to classify EUC management activities into finer subcategories and further investigate the effects that these subcategories have on EUC result.

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